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Developing First-Year Students' Biological Information Literacy: Collaboration between Libraries and Disciplinary Faculty in IMPACT Classrooms

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Developing first-year students' biological information literacy

**Collaboration between Libraries and
disciplinary faculty in IMPACT classrooms**

**Dr. Nancy Pelaez
Clarence Maybee
Maribeth Slebodnik**

Imagine....

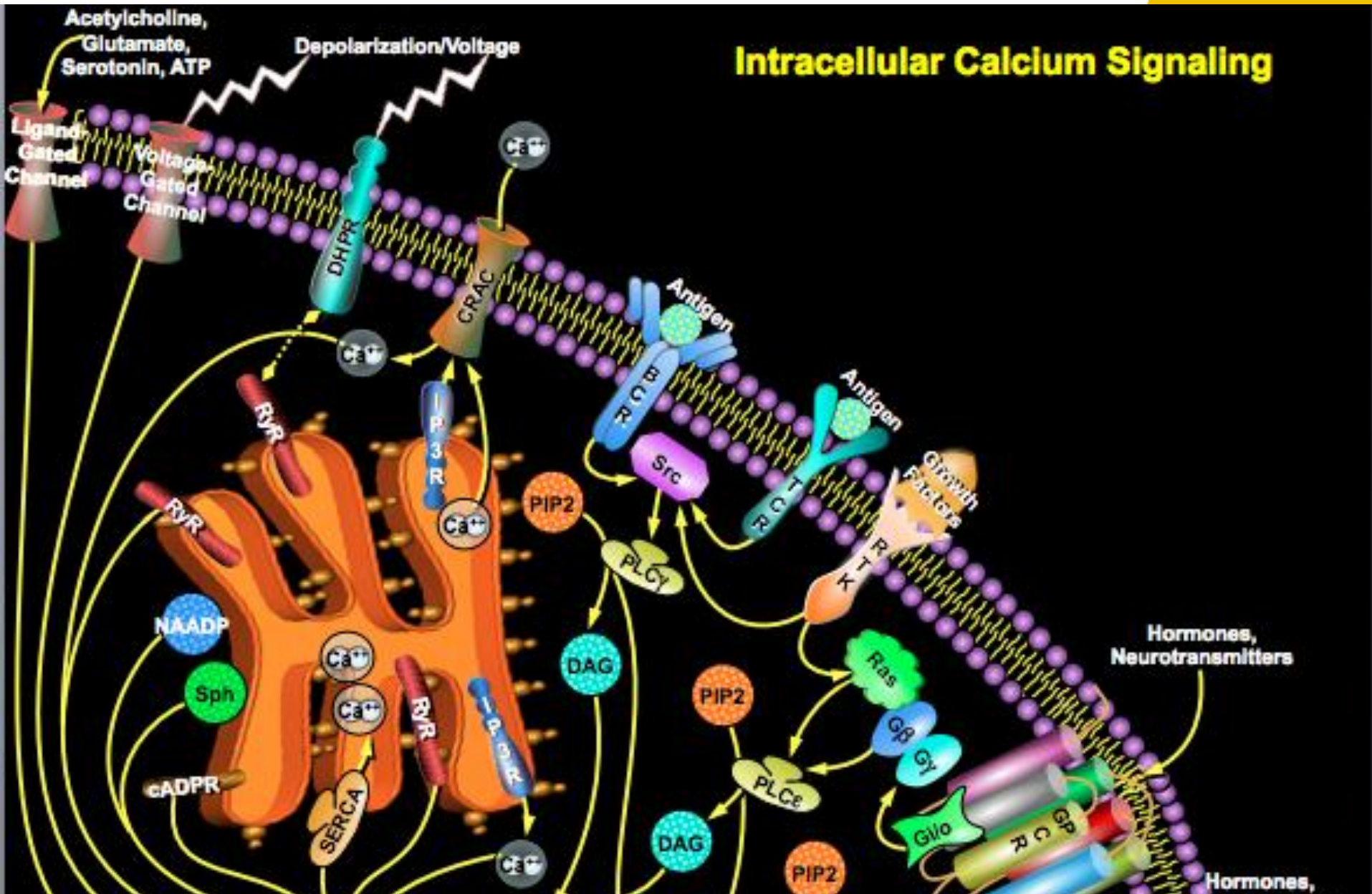
Think of a specific time in your life when you felt that you learned a lot.

What was the space around you like at that time?

What about the environment was conducive to learning?

How we began

- Observed need for students to develop “biological literacy” to become empowered professionals (not always biologists) – Nancy Pelaez
- Developed initial resources and strategies – Maribeth Slebodnik
- Brought informed learning perspective – Clarence Maybee
- Jointly worked on modified BIO13100 class in Spring 2011 and Spring 2012



Spring 2011

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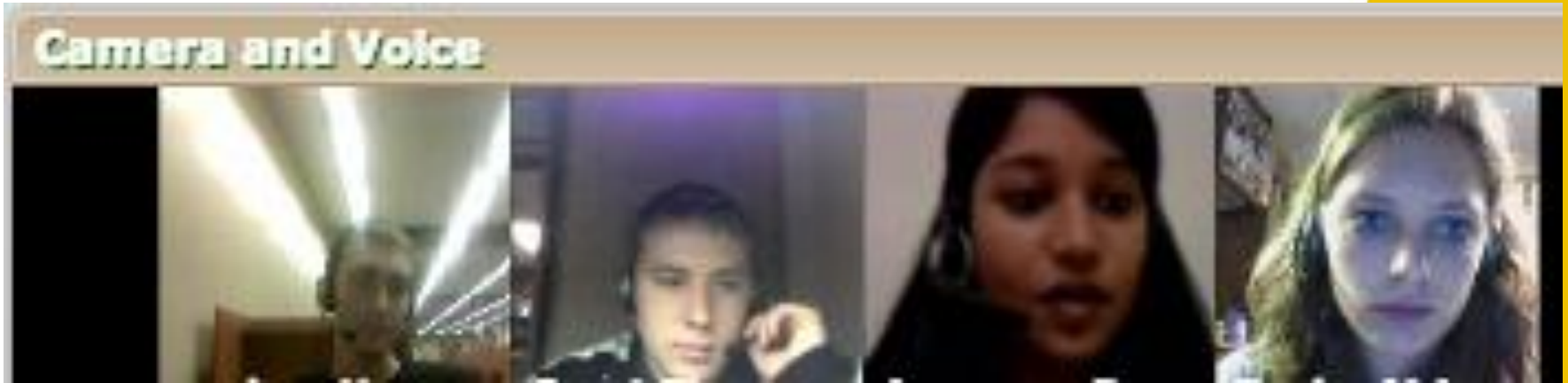
New elements of the course

- Focused on establishing peer led team learning (PLTL) in BIO13100
- Peer led teams were videotaped using web cameras and Adobe Connect
- Information literacy assignments were added to the weekly problem sets that students worked on in their teams each week

Information literacy problem sets

- Beginning of the semester - finding images, locating articles, comparing news to research articles
- Mid-semester - examining biological experiments
- End-of-semester – students applied what they learned previously to research and created an academic poster

Video footage of cyber PLTL sessions



Student 1: Gives an example of faked findings about the evolution of moths.

Student 2: Says a prof used this study as an example and that student 1 may have read something that wasn't true.

Student 1: On the peppered moth Wikipedia page, Wikipedia supports his argument.

Student 3: Questions the veracity of Wikipedia. (credibility comes up naturally - would have been a good place for discussion of credibility)

Learning in the IMPACT classroom



- Teams came together weekly in the classroom for discussion and lecture

Peer Leaders

- Peer leaders (undergraduates & a grad TA) were recruited and trained
- PLs led weekly small group sessions to work through problem sets and projects
- They developed leadership, instructional and observational/listening skills as well as biological expertise and confidence
- Reflection questions and skills inventory helped them assess their own competencies

Reviewing the Video Footage

Some students did not connect answering the information literacy questions and developing a sense of how biological information has relevance for them personally.



Spring 2012

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Informed learning is...

“using information to learn about a subject”

Six Frames of Informed Learning



Christine Bruce
introducing the
Six Frames,
Aug 2012

Content
Competency
Learning to learn
Personal relevance
Social impact
Relational (all together)

New elements of the course

- Used informed learning approach to help students consider personal and social relevance of biological information
- Students can opt out of cyber sessions; all chose face to face meetings

Getting personal

- Students were asked to develop a personally relevant question that could be answered by engaging biological information.
- Problem set activities were essentially the same as in spring 2011, but the students were encouraged to explore their personally relevant question
- Peer leaders prompted students to develop questions throughout the beginning of the semester

Peer Led Team Learning (PLTL) workshops

Peer Leader Reflection Questions

Peer Leader Name:

Workshop Date:

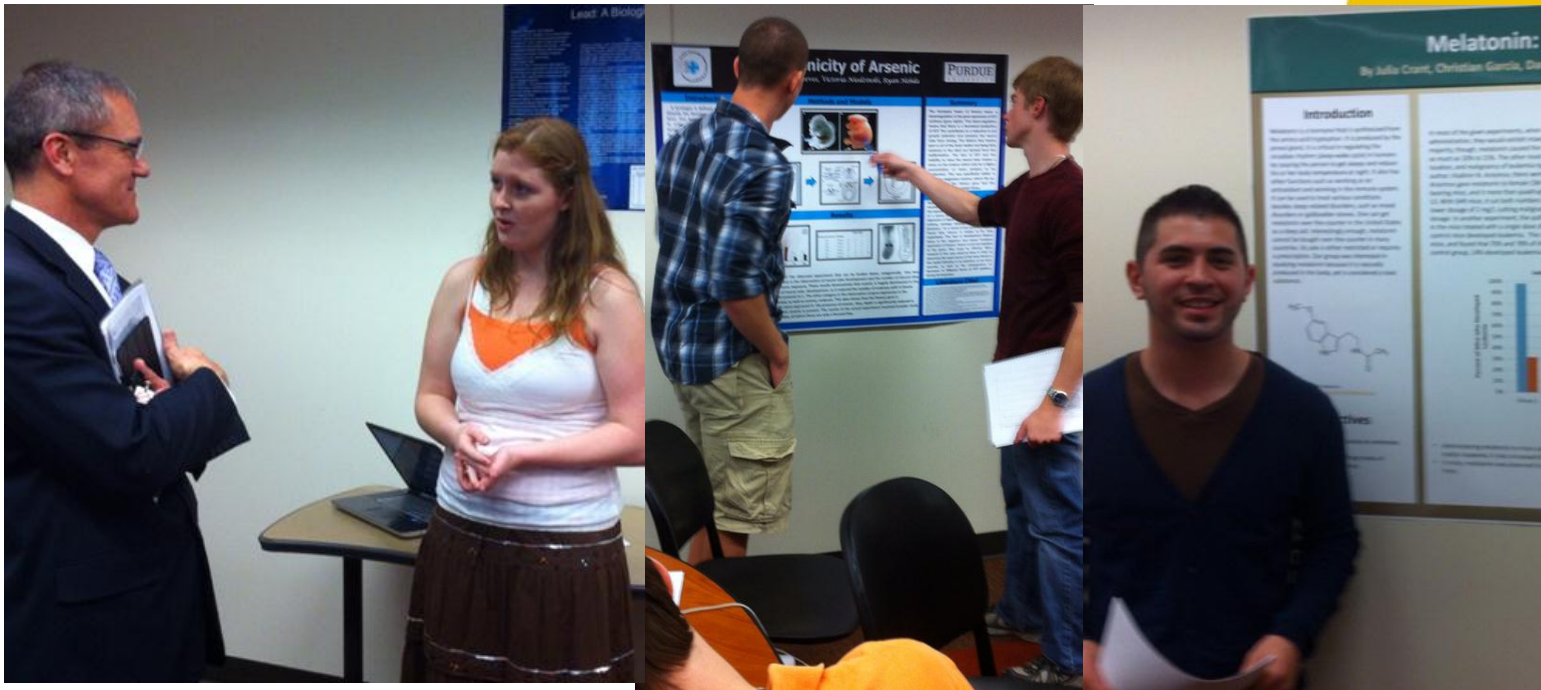
Problem Set:

Names of Students Who Attended:

1. How many students were:
 - Present for today's workshop?
 - Absent from this workshop?
2. Did your workshop students do any of the following?
 - f1. Explore biological information sources to answer a personal question
 - f2. Develop a personal strategy to find information needed for a biological problem (skill)
 - f3. Modify strategies for finding information by reflecting and then deciding how to improve a strategy
 - f4. Reflect on the quality of biological information and evaluate how useful it is for their question
 - f5. Find and interpret biological examples to illustrate what they have learned
 - f6. Use biological information to respond to ideas presented by others or issues of social relevance

Poster project

Students worked in groups to present posters on a topic of personal relevance



Thalidomide as an inhibitor of angiogenesis

Sohaila E. Arizmendi, Shravani Merugureddy, Jacob E. Meyers, Sean Tague
Department of Biological Sciences
Purdue University

ALSO <http://will567.edu.glogster.com/poster-for-bio-131/>

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Introduction

Thalidomide (the active agent of Contergan), sedative originally used to treat morning sickness, is also a teratogen that induces birth defects in humans such as limb truncations and microphthalmia. More than 10,000 children were born with severe birth defects after drug regulators in Europe approved the medication in the 1960s for treating nausea and vomiting in pregnant women. Today, thalidomide is still used in the treatment of leprosy and multiple myeloma, although how it causes limb malformation and other developmental defects is unknown.

Purpose

To study the mechanism of thalidomide as a potential angiogenesis inhibitor by examining the effect of thalidomide on growing vasculature in the chicken chorioallantoic membrane and in the rabbit cornea. Angiogenesis is the formation of new blood vessels from sprouts of preexisting vessels. Therefore, the limb bud, formed in early limb development and requires interaction between angiogenesis and vasculogenesis, is a particularly vulnerable target to a teratogen that inhibits endothelial cell function.

Methods

Chicken chorioallantoic membrane assays were conducted and the results were recorded after 48 hours after 0.5% carboxymethylcellulose pellet was implanted. Pellets were made by mixing 110 μ L of saline that contained 12 μ g of recombinant bFGF, basic fibroblast growth factor, with 40 mg of sucralfate. Then this was added to 80 μ L of 12% Hydron in ethanol. 10 μ L aliquots of this mixture were pipetted into Teflon pegs and dried, thus creating 17 pellets total. Adding the sucralfate to the pellet protects the bFGF from degradation, which then produces consistent aggressive angiogenesis that is more pronounced. The release of the bFGF from the pellets could be detected up to four days after the pellets were formed. The pellets were implanted into the corneal micropockets of each eye of a female New Zealand White rabbit. Examination after inserting the pellets found that blood vessel growth increased in the cornea toward the pellet. Thus, pellets with sucralfate did not alone induce angiogenesis. The rabbits were fed 2 days after implantation of the pellets by gastric lavage. The immunosuppressed animals received radiation of 6 Gy for 6 minutes right after implantation of the pellets. This radiation resulted in a decrease in the marked leukocytopenia. The area of corneal neovascularization was determined. The formula $C/12 \times 3.1416 [r^2 - (r-L)^2]$ was used to determine the area of a circular band segment. This formula is said to provide the most accurate approximation of the area of the neovascularization band that grows toward the pellet inserted into the animals. This increase in neovascularization was only seen in control animals and was never seen in thalidomide-treated animals.

Results

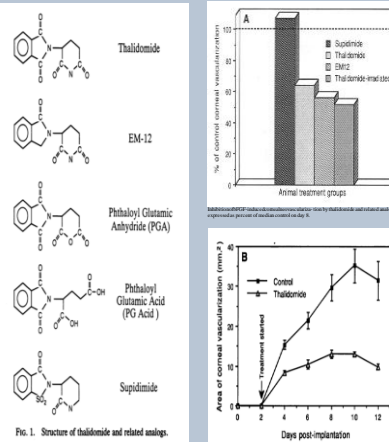


FIG. 1. Structure of thalidomide and related analogs.

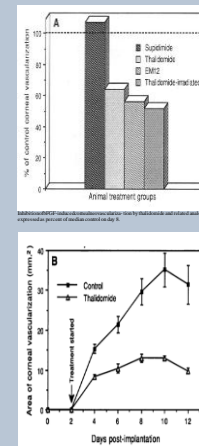


Figure 1: Bar graph showing the percentage of corneal neovascularization for different animal treatment groups. The y-axis is labeled '% of corneal neovascularization' and ranges from 0 to 100. The x-axis is labeled 'Animal treatment groups'. The legend indicates: Suplidimide (white bar), Thalidomide (black bar), EM12 (hatched bar), and Thalidomide-emulid (dotted bar).

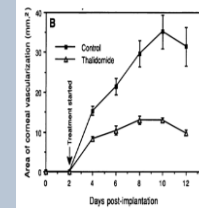


Figure 2: Line graph showing the area of corneal neovascularization over time for Control and Thalidomide groups. The y-axis is labeled 'Area of corneal neovascularization (mm²)' and ranges from 0 to 40. The x-axis is labeled 'Days post-implantation' and ranges from 0 to 12. The legend indicates: Control (solid line with circles) and Thalidomide (dashed line with squares).

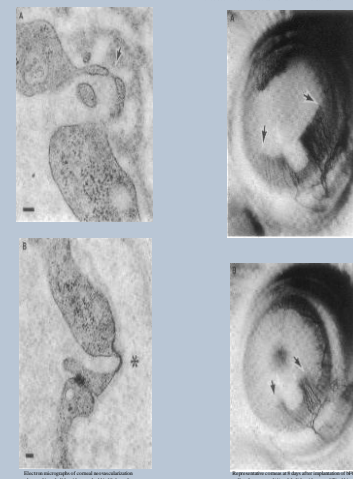


Figure 3: Micrographs showing the effect of thalidomide on corneal neovascularization. The top row shows control corneas with significant neovascularization (arrows). The bottom row shows thalidomide-treated corneas with reduced neovascularization (arrows).

Discussion

Neither thalidomide nor EM-12, a related teratogenic analog exhibited any inhibitory activity on blood vessel growth. Treatment with a teratogenic dose (200mg/kg) of thalidomide resulted in a inhibition of the area of vascularized cornea that ranged from 30 to 51%. The inhibition of angiogenesis by thalidomide was seen after only two doses. Other analogs, PGA and PG acid, displayed weaker inhibitory effect. Vessels in the thalidomide treated group demonstrated fenestrations not seen in control animals. The corneal neovascularization from thalidomide-treated rabbits appeared more immature than that observed in control animals with poorly formed cell junctions, incomplete basement membrane, and fewer associated pericytes.

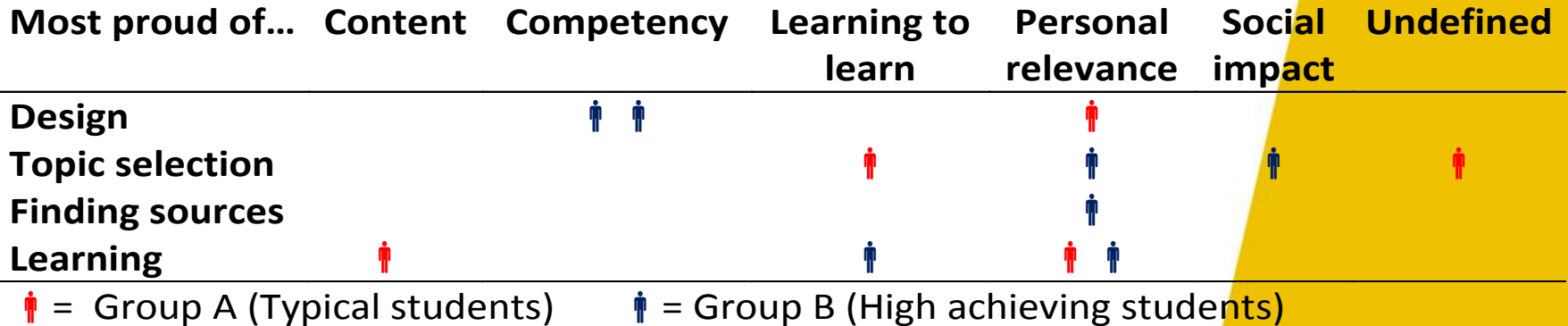
Conclusion

Thalidomide inhibits angiogenesis, but its mechanism in doing so is still unknown. Thalidomide must be processed by the liver into a metabolite that is the teratogen that inhibits angiogenesis. It was the only teratogen shown to inhibit angiogenesis when ingested orally when compared to antimitotic agents, *cis*-retinoic acid, tamoxifen, and others. Due to this property, thalidomide is being looked at as a treatment for harmful angiogenesis, such as tumors.

References

D'Amato, Robert J, Loughnan, Michael S, Flynn, Evelyn, Folkman, Judah. (1994) Thalidomide is an inhibitor of angiogenesis. *Proc Natl Acad Sci U S A*, 91, 4082-4085.

What were students most proud of when completing the academic poster?



"I pick[ed] a topic that I have always been interested in, but never knew anything about it. I learned during this experience. I learned more about Chinese herbology and it's scientific application..."

Student from Group A

BIO 13100 Biology II Development, Structure, and Function of Organisms Poster Peer Review

Your Name: _____

Poster Co-Author: _____

Peer Assessment: Give the % effort for each group member. Each row must total 100%.

		Your Score				Total
		1	2	3	4	
1	Defining a research topic for the assignment	25	25	25	25	100
2	Searching online for information to locate and retrieve useful information resources	25	25	25	25	100
3	Reading primary literature, scientific web resources, and research reviews	25	25	25	25	100
4	Critically evaluating the information to identify material that is appropriate for your poster	25	25	25	25	100
5	Citing scientific research accurately and using information ethically and legally in creating your poster	25	25	25	25	100
6	Contributing to making your poster board presentation	25	25	25	25	100
7	Developing the ability to justify what is known based on evidence	25	25	25	25	100

Describe one personal accomplishment that you feel each of your co-presenters should be most proud of and that you will remember about their work on this poster.

1. *Chloe's drawings and illustrations really made the presentation attractive.*
 2. *The preparation really helped the rest of the group understand the paper.*
 3. *Her organization and leadership made sure the project moved smoothly.*

What is your own personal accomplishment that you will remember and be most proud of for this poster?

I thought the papers we used were complicated and they led my group and I tackled it with teamwork and dedication. I'm extremely proud at the level of difficulty of the paper that we chose and worked through.

What did the presenter say to convince you that this research should be noticed?

Examples from peer reviews of Group A and Group B posters

- No cure has been found (Social impact)
- Brother has Crohn's Disease (Personal relevance)
- Provides info on how brain interprets auditory signals (Content)
- May lead to therapies (Social impact)

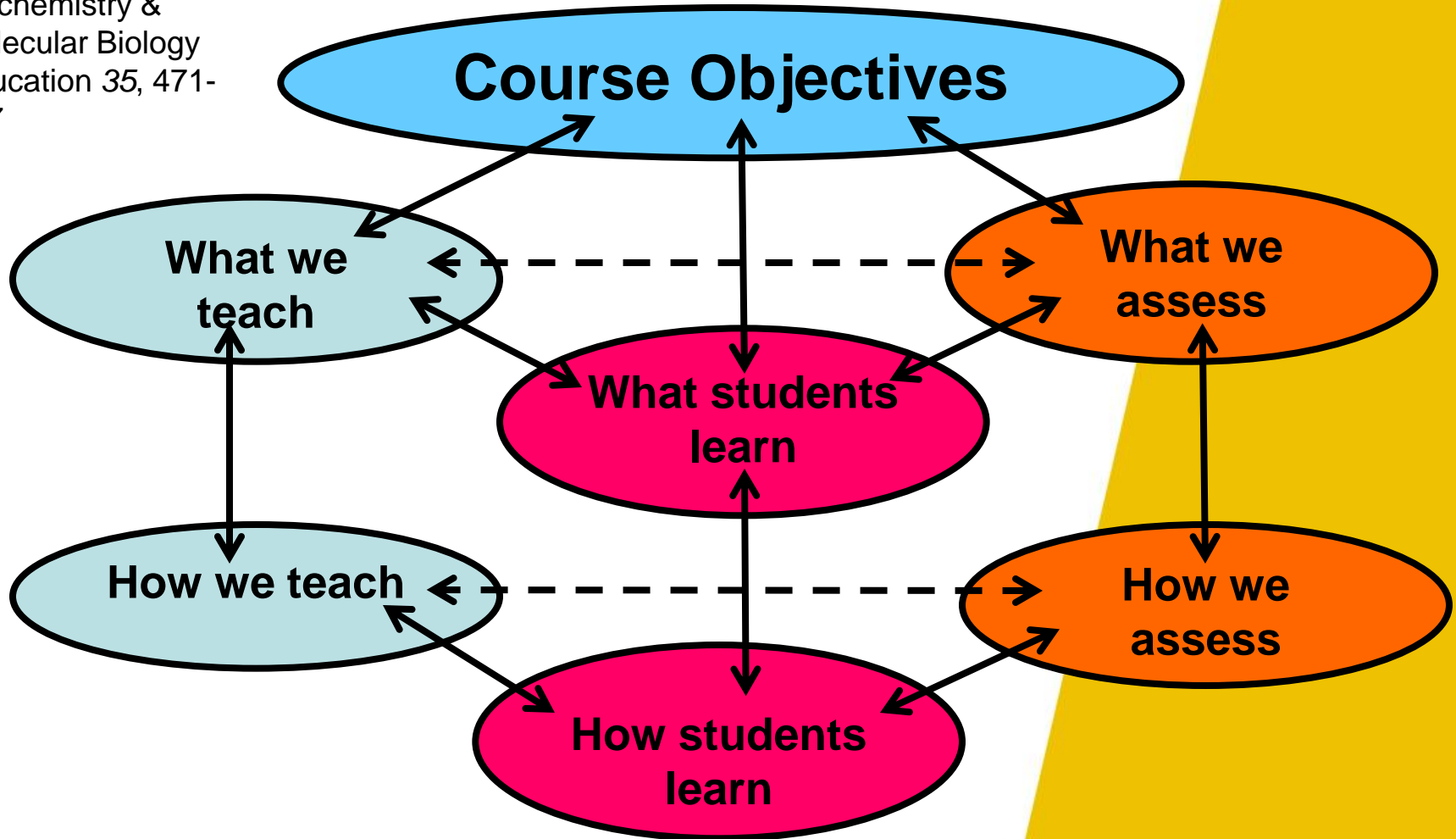
Personal accomplishments & 6 Frames		
Frame	Number	Percentage
Competency	22	46%
Learning to learn	7	15%
Personal relevance	8	17%
Social impact	4	8%
Content	2	4%
Undefined	3	6%

What we learned

- PLTL workshops worked equally well with typical students and with high achieving students. Students from groups under-represented in the sciences are attracted to and successful with this approach.
- It took a long time for students to identify a personally relevant question that could be answered with biological information sources.
- Video footage of cyber PLTL sessions makes it possible for us to observe students' reactions to our instructional efforts.

Not just WHAT students learn, but HOW they learn

Anderson (2007)
Biochemistry &
Molecular Biology
Education 35, 471-
477

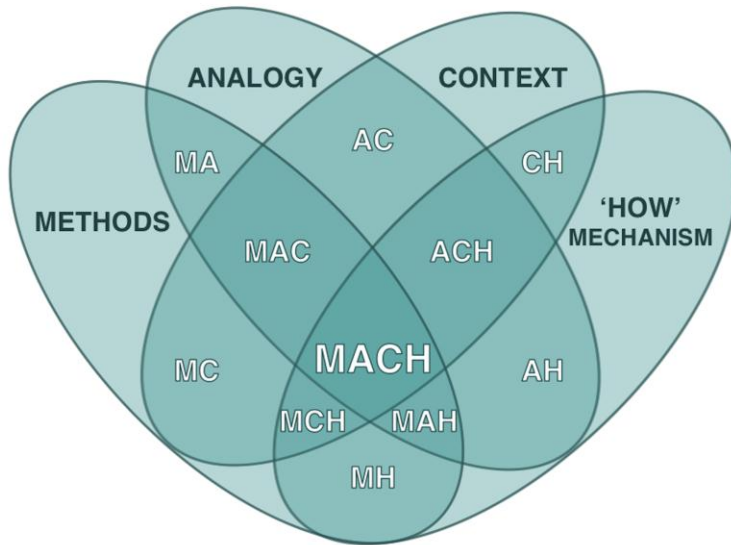


Assessment-driven curriculum change

Looking Forward

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Next Steps



Is your explanation robust? Does it:

- M. Consider the tools and data used to generate and evaluate the explanation - *Methods?*
 - A.1. Make use of appropriate analogies and models - *Analogy?*
 - A.2. Tell a story as a narration that makes sense and relates to a purpose - *Story?*
 - C.1. Identify and limit the scope for a mechanism to groups of organisms or cell types - *Context of Biology?*
 - C.2. Relate the mechanism to personal or social concerns - *Context of Society?*
-
- H.1. Consider entities, their interactions, and their states or variable properties - *How of Entities?*
 - H.2. Include changing states of entities to produce activities - *How of Activities?*
 - H.3. Translate vertically to consider several levels of biological organization - *How of Organization?*
 - H.4. Translate horizontally to consider spatial and temporal changes - *How of Organization?*
-

Sharing

- The approach developed for introducing information literacy pedagogy into BIOL13100 would apply to any discipline-specific course where HOW students learn a particular subject is just as important as WHAT they learn.
- We are disseminating what we learned through:
 - IMPACT
 - Educational conferences

Thank You BIOL13100 IMPACT Team!

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- | | |
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- | | |
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Thank You BIOL13100 IMPACT Team!

Worksheet and Question Developers

- | | |
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Questions?

Thank you.

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